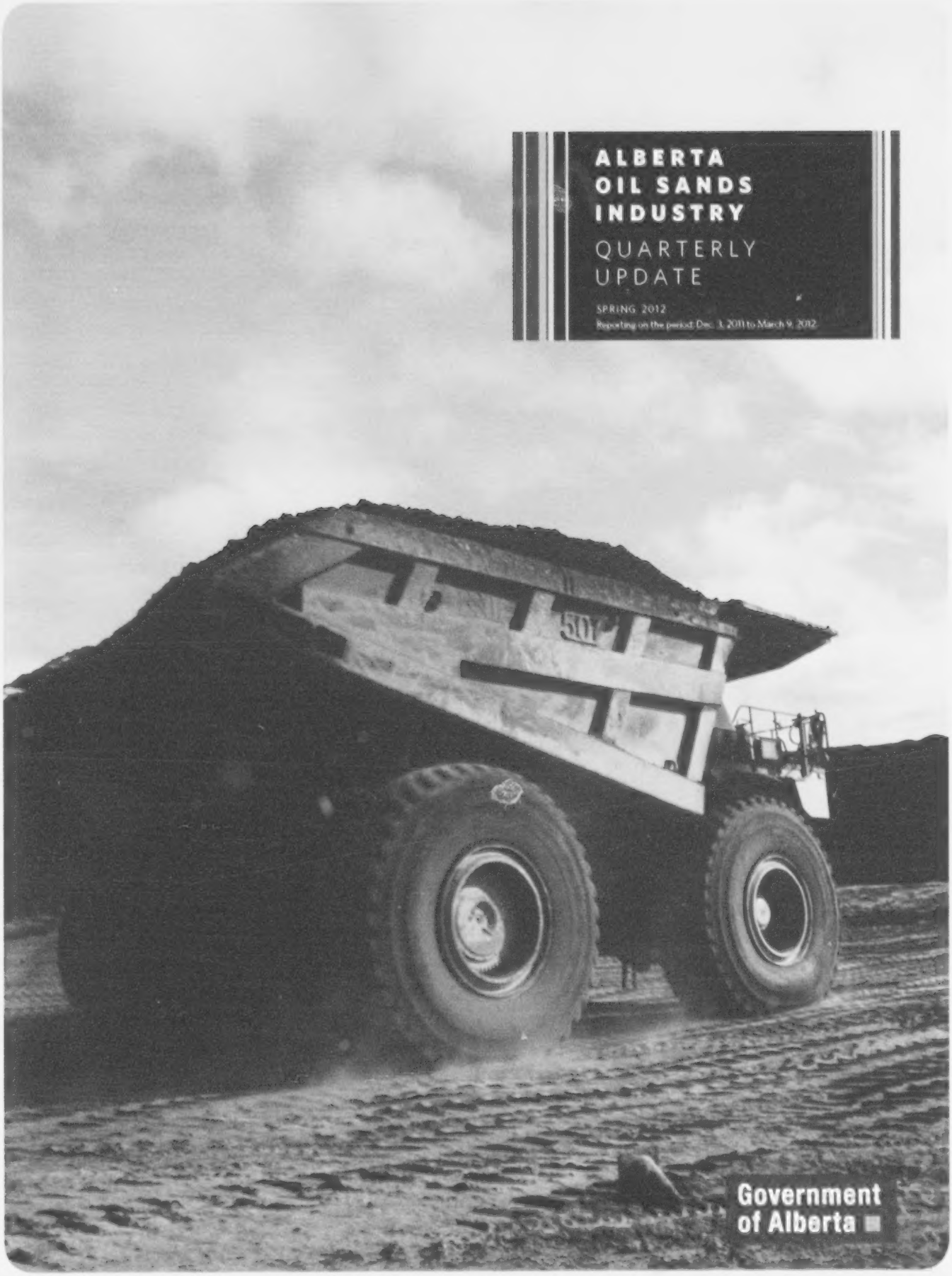
ALBERTA
OIL SANDS
INDUSTRY
QUARTERLY
UPDATE
SPRING 2012
Reporting on the period Dec. 3, 2011 to March 9, 2012
Government
of Alberta

All about the oil sands

Background of an important global resource

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All photos by Joey Podlubny © 2012 JuneWarren-Nickle's Energy Group

Canada has the third-largest oil reserves in the world, next to Saudi Arabia and Venezuela. Of Canada's 179 billion barrels of oil reserves, 170 billion barrels are located in Alberta, and have the special quality of being bitumen. This is a resource that has been developed for decades, but is only now coming into the forefront of the global energy industry, as conventional supplies—so-called "easy" oil—continue to be depleted. The figure of 170 billion barrels represents what is considered economically recoverable with today's technology, but with new technologies, this reserve estimate could be increased to as much as 315 billion barrels.

There are three major bitumen (or oil sands) deposits in Alberta. The largest is the Athabasca deposit, located in the province's northeast in the Regional Municipality of Wood Buffalo. The main population centre of the Athabasca deposit is the City of Fort McMurray. The second-largest oil sands deposit is referred to as Cold Lake, just south of Athabasca, with the main population centre the City of Cold Lake. The smallest oil sands deposit is known as Peace River, which is located in northwest central Alberta. A fourth deposit called Wabasca links to the Athabasca and is generally lumped in with that area.

The existence of bitumen in Alberta has been known for a long time. The first mention of it in Canadian history was in 1719, when a Cree named Wapasu brought a sample of the "gum" to a Hudson's Bay trading post. First Nations in what is now the Wood Buffalo area had traditionally used the bitumen, which seeps from outcrops along the Athabasca River, to waterproof their canoes.

Today bitumen is produced as an energy source by two means—mining and in situ. The majority of oil sands production is done by surface mining, but this will likely change in the future, as 80 per cent of Alberta's bitumen deposits are too deep underground to economically employ this technology.

Right now there are essentially two commercial methods of in situ (Latin for "in place," essentially meaning wells are used rather than trucks and shovels). In cyclic steam stimulation (CSS), high-pressure steam is injected into directional wells drilled from pads for a period of time, then the steam is left to soak in the reservoir for a period, melting the bitumen, and then the same wells are switched into production mode, bringing the bitumen to the surface.

In steam assisted gravity drainage (SAGD), parallel horizontal well pairs are drilled from well pads at the surface. One is drilled near the top of the target reservoir, while the other is drilled near its bottom. Steam is injected into the top well, a steam chamber forms, and via gravity, the melted bitumen flows into the lower well and is pumped to the surface using artificial lift.

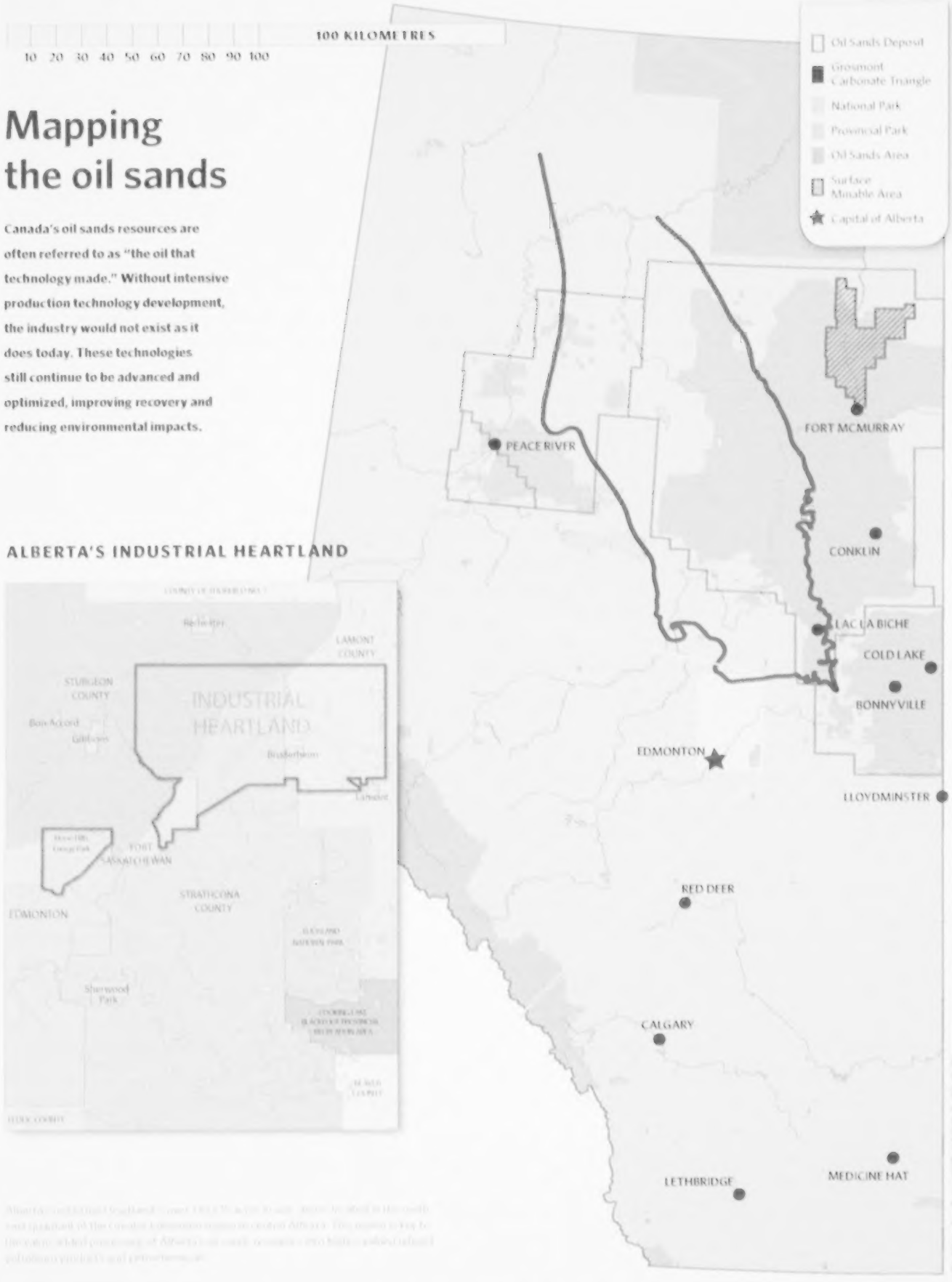
Both SAGD and CSS are used in the Cold Lake and Peace River deposits, while SAGD is the in situ technology of choice in the Athabasca deposit. The choice is based on a number of things including geology. The technologies combined currently produce just over one million barrels per day.

Research is underway on a number of other production technologies designed to optimize production, including variations on solvent-assisted SAGD and CSS, recovery using electricity and in situ combustion.

Bitumen that has not been processed, or "upgraded," can be used directly as asphalt. It must be diluted to travel by pipeline. Adding value, some producers upgrade their product into synthetic crude oil (SCO), which is a refinery feedstock. At these refineries it can be transformed into transportation fuels and other products. ■

Mapping the oil sands

Canada's oil sands resources are often referred to as "the oil that technology made." Without intensive production technology development, the industry would not exist as it does today. These technologies still continue to be advanced and optimized, improving recovery and reducing environmental impacts.



Government update

NEW ADVISORY BODY TO COORDINATE TRANSPORTATION PLANNING IN OIL SANDS REGION

A new advisory committee will review and will make recommendations to the Alberta government on the current and future transportation needs of the Athabasca oil sands region. The committee of municipal, industry and provincial representatives will take into account the region's unique economic and infrastructure needs and the importance of the oil sands to the province's economy.

The Athabasca Oil Sands Area Transportation Coordinating Committee will include representatives from the Regional Municipality of Wood Buffalo, the Oil Sands Developers Group, the Alberta Economic Development Authority, the Fort McMurray Airport Authority, the Northern Alberta Development Council, Cindy Ady, MLA Calgary-Shaw, and the Alberta government.

The committee will meet a minimum of four times per year and will provide strategic advice and recommendations on transportation planning, design, funding, construction, operations and maintenance, including all classes of roads, transit, rail and air traffic within the Athabasca oil sands area.

This committee is part of Responsible Actions, Alberta's 20-year strategic plan for the oil sands, which includes efforts to support further planning and development of vibrant communities in the oil sands regions. For more information about Responsible Actions, visit www.oilsands.alberta.ca.

CANADA AND ALBERTA TAKE ACTION TO IMPLEMENT WORLD-CLASS MONITORING SYSTEM FOR THE OIL SANDS

Increased air, water, land and biodiversity monitoring in the oil sands will begin this year as the Government of Canada and Government of Alberta take a major step forward in their partnership to improve environmental monitoring in the oil sands region.

The Joint Canada-Alberta Implementation Plan for Oil Sands Monitoring commits to a scientifically rigorous, comprehensive, integrated and transparent environmental monitoring program for the region. It outlines the path forward to enhance the monitoring of water, air, land and biodiversity in the oil sands by demonstrating how more sites will be sampled for more substances more frequently. The program is designed to provide an improved understanding of the long-term cumulative effects of oil sands development.

The three-year implementation plan begins this spring with increased sampling frequency, parameters and locations. It will also integrate relevant parts of existing monitoring efforts and will give government and industry the scientific foundation necessary to continue to promote the environmentally sustainable development of the oil sands. The implementation plan reflects the *Integrated Oil Sands Environment Monitoring Plan* released by Environment Canada in July and will be consistent with the Government of Alberta's plans for a province-wide environmental monitoring system.

As the process continues to move forward, implementation of the monitoring program will be jointly managed by the Government of Canada and the Government of Alberta. Annual progress reports on implementation will be prepared for the first three years, with an external scientific peer review of the program at the end of the third year. Following that, a full external scientific review of the new program will be conducted every five years.

USE OF NEW TECHNOLOGIES SPURS PROVINCE TO RECORD LAND REVENUES

Capping a record year that saw renewed confidence in Alberta's oilpatch, for the first time in provincial history Alberta has exceeded $3 billion in land sales for a calendar year. Revenues for the final calendar year sale of provincial petroleum and natural gas mineral leases and licences, also known as land sales, were $145,621,531.32. This brings the total revenue collected to $3.54 billion for the 2010 calendar year.

Several records were set in 2010. In the August 24 sale, a record was set for the highest-ever price paid for a petroleum and natural gas parcel, more than $12.5 million for a licence southeast of Fox Creek, Alta. The June 1 sale netted the highest-ever single-sale record, collecting more than $834 million for the province.

Total calendar sales in 2010 were $7.39 billion. This was the first time the province collected more than $7 billion in revenues from petroleum and natural gas land sales.

PREMIER REDFORD WELCOMES KEYSTONE XL REAPPLICATION

Premier Alison Redford issued the following statement in response to TransCanada Corporation's February announcement that it will soon reapply for a presidential permit for the Keystone XL pipeline, and in the meantime begin work on the pipeline's southern leg, known as the Gulf Coast Project. Premier Redford was visiting Chicago at the time.

"Today's announcement from TransCanada is welcome news for Albertans. I believe very strongly in the merits

and benefits of this critical pipeline and the Government of Alberta will continue to advocate for our energy interests in the United States.

"The Keystone XL pipeline is a game-changing piece of infrastructure that will create thousands of job opportunities on both sides of the border. It will reduce America's need for oil imports from jurisdictions with much weaker environmental policies and who do not share the same values as Canadians and Americans.

"For Alberta, Keystone means our oil has greater access to our largest and most important trading partner. Being in Chicago is clearly demonstrating that there are strong supporters of our energy in the U.S. It also demonstrates that more work needs to be done to ensure our American friends fully understand the rigorous processes we have in place to develop our oil sands responsibly. I am very proud to tell our story and I will use my time [in Chicago] and when I am in Washington and New York to champion our responsible energy production.

"Our government recognizes that the approval of the Keystone XL pipeline is a U.S. decision. I remain optimistic that this project will be evaluated on its merits and that the discussions surrounding it will be guided by science and fact.

"I also applaud Transcanada's decision to proceed as soon as possible with construction of the Gulf Coast Project, which will carry crude from Cushing, Oklahoma to refineries on the Gulf Coast. This, together with Enbridge's Seaway pipeline, will help close the gap between North American and international oil prices, benefitting Canadian producers and increasing royalties and tax revenues to help pay for health care, education and other public services."

PREMIER REDFORD PLEASED WITH EUROPE'S FUEL QUALITY DIRECTIVE VOTE

Alberta Premier Alison Redford issued the following statement in response to the February European Union (EU) voting against including crude from the oil sands under the fuel quality directive (FQD):

"Alberta has always advocated that the fuel quality directive should treat all crudes equally and be based on scientific, verifiable data. It is very encouraging to see [this] vote from EU technical experts. Our hope is that [the] decision from the technical experts is not circumvented for political reasons.

"This government has worked diligently to ensure Europe has access to the most current and up-to-date information on Alberta's responsible oil sands development. Albertans can feel confident that this government will continue to be a strong voice in support of this important industry.

"[This] vote is a small victory for Alberta, but the process in Europe means that a discriminatory FQD could resurface. Alberta remains committed to working with the EU on the FQD to ensure it is transparent, accountable and scientifically supported."

PUBLIC HEARING PROCESS STARTS FOR THE ENBRIDGE NORTHERN GATEWAY PROJECT

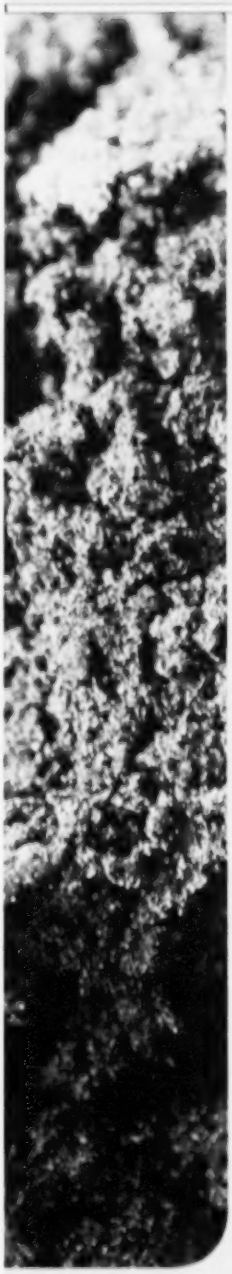
On May 27, 2010, Northern Gateway Pipelines Limited Partnership submitted its application to the National Energy Board (NEB) with respect to the Enbridge Northern Gateway Project. A joint review panel was established by the Minister of the Environment and the NEB to assess the environmental effects of the proposed project and review the application under both the Canadian Environmental Assessment Act and the National Energy Board Act. The panel recently issued the hearing order and held the first public hearings on Jan. 10, 2012. Based on the projected schedule, the panel anticipates releasing the Environmental Assessment Report in the fall of 2013 and its final decision on the project around the end of 2013.

The proposed Northern Gateway project involves the construction of two 1,170-kilometre-long pipelines running from Bruderheim, Alta., to Kitimat, B.C., and the construction and operation of the Kitimat Marine Terminal.

For more information on the joint review process, please visit the panel's website at www.gatewaypanelreview.gc.ca.

What's new in the oil sands

Key updates from spring 2012



■ North West Upgrading Inc. (NWU) aims to make a final investment decision early in 2012 for the $5+ billion, 50,000-barrel-per-day first phase of its proposed 150,000-barrel-per-day bitumen refinery near Edmonton.

"We are now in the process of taking a financial proposal to our board of directors for approval," says Jerry Crail, NWU's vice-president of engineering and construction. "A detailed financial plan is already in place, and private investors and financial institutions have pledged funding."

The refinery will be owned equally by NWU and Canadian Natural Resources Limited, with NWU acting as operator. Canadian Natural, which plans to supply the facility with 12,500 barrels of bitumen per day, also expects board sanction for the project in 2012. The facility would also receive volumes from the Government of Alberta's Bitumen Royalty in-Kind program.

"In March 2012, detailed engineering work is due to start," Crail says, adding that long-lead items, including reactors and heavy wall columns, have already been fabricated and are lying in Iowa, waiting to be trucked to the construction site.

Six companies have been pre-qualified for the main construction contracts. They are Lurgi AG of Germany, Japan's Toyo Engineering Corporation, WorleyParsons Ltd. of Australia, Calgary-based IMV Projects, and Jacobs Engineering Group Inc. and Fluor Corporation, both of the United States. Crail did not comment on the pre-qualification process, but says at this point no selection has been made.

■ Southern Pacific Resource Corp. is seeking to triple production at its STP-McKay project to 36,000 barrels per day. The company has submitted an application to the Alberta Energy Resources Conservation Board (ERCB) and Alberta Environment and Water for approval to expand its 12,000-barrel-per-day STP-McKay Phase 1 project area, allowing it to construct a second steam assisted gravity drainage (SAGD) facility within the project area capable of producing an additional 24,000 barrels per day of bitumen.

The company says that STP-McKay Phase 2 will have the benefit of all the information obtained from the construction and preliminary operations at STP-McKay Phase 1, which is currently under construction and scheduled for first steam in the second quarter of 2012. The company is budgeting 18 months for regulatory approval of Phase 2, based on the 15 months required for approval of Phase 1.

■ The Alberta government has launched a new web portal (www.osip.alberta.ca) designed to make it easy to find detailed information on the environmental performance of Alberta's oil sands facilities. Searchable data includes such things as facility-specific water use, greenhouse gas emissions, tailings pond size, and land disturbance and reclamation.

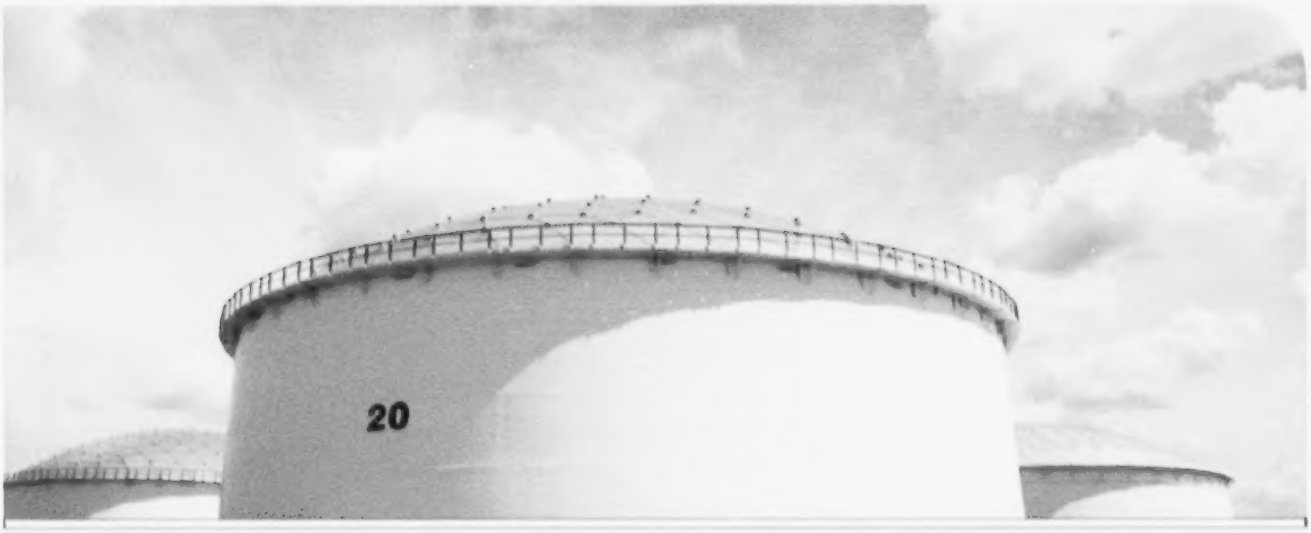
While oil sands data and information has always been publicly available, it has often been difficult to find and time-consuming to access. The portal is the culmination of three years of work to compile data and information from a variety of sources.

■ Canada's oil sands producers have formed a new alliance, Canada's Oil Sands Innovation Alliance (COSIA), focused on accelerating the pace of improving environmental performance.

Chief executive officers of 12 companies have signed the alliance's founding charter, committing to COSIA's vision to "enable responsible and sustainable growth of Canada's oil sands while delivering accelerated improvement in environmental performance through collaborative action and innovation."

Members of the alliance include: BP Canada Energy Company, Canadian Natural Resources, Cenovus Energy Inc., ConocoPhillips Canada, Devon Canada Corporation, Imperial Oil Limited, Nexen Inc., Shell Canada Limited, Statoil Canada Ltd., Suncor Energy Inc., Teck Resources Limited and Total E&P Canada Ltd.

The creation of COSIA as an independent alliance builds on work done over the past several years by both oil sands industry members and research and development organizations, the alliance says. COSIA will take these efforts to a much larger scale and will help the industry address environmental challenges by breaking down barriers in the areas of funding, intellectual property enforcement and human resources that may otherwise impede progress on environmental performance.



SNC-Lavalin Group Inc. has been awarded a major contract by an oil sands mining producer to provide engineering, procurement and construction services for a froth treatment plant in the Fort McMurray, Alta., region, valued in excess of $650 million.

The froth treatment plant will process 155,000 barrels of feedstock per day from the bitumen extraction plant in the form of bitumen froth. The engineering phase is now underway and construction is scheduled to begin in February 2012. Mechanical completion for the construction is expected in September 2014.

While the customer was not publicly disclosed, there is speculation that the work is for an expansion of Canadian Natural's Horizon project.

The final regulatory approvals are now in place and construction is underway for Grizzly Oil Sands ULC's Algar Lake SAGD project. The approval, granted in December, is for a 11,300-barrel-per-day project that will be built in two 5,560-barrel-per-day phases.

Grizzly says it is on budget and on track for an early 2013 start-up for the first phase, which has an estimated cost of about $220 million.

Paramount Resources Ltd. is transferring its Alberta oil sands and carbonate bitumen interests to a new wholly owned subsidiary, Cavalier Energy Inc. On completion of the reorganization, all of Paramount's oil sands and bitumen carbonate leases will be owned by Cavalier (originally intended to be called Pixar Petroleum Corp.), including Hoole and Saleski.

Paramount says the creation of Cavalier will allow accelerated development of these high-impact, capital-intensive properties on a self-funding basis. Cavalier's near-term focus is expected to be the development of its 100-per-cent-owned leases at Hoole and the further delineation of its carbonate bitumen leases at Saleski.

Paramount says the majority of the work necessary for the regulatory application for a commercial development at Hoole has been completed, together with preliminary front-end engineering and design, and reservoir modelling and simulation, which has been verified by core flood experiments. Preparatory work for project development is continuing, including field activities focused on optimizing water source and disposal options.

Statoil Canada has applied for regulatory approval to test the injection of solvent at its Leismer SAGD project and says if the pilot proves successful, the process could see commercial use at Leismer as early as 2017 if it can find a long-term condensate-type diluent supply. If it is successful, solvent co-injection could also be used at the planned Corner project, Statoil's next phase of oil sands development.

The company says co-injection will have the overall effect of improving economics while reducing greenhouse gas emissions. Statoil is hoping for regulatory approval before June 2012. Construction of the solvent injection facilities will begin following approval and is tentatively scheduled to start in the second quarter of 2012.

Following a six-year regulatory process, Total E&P Canada has received federal cabinet approval for its $9-billion Joslyn North oil sands mine about 70 kilometres north of Fort McMurray.

The production potential of the Joslyn North mine is currently estimated at 100,000 barrels per day with further expansion potential up to 200,000 barrels per day. First production is planned for 2018 at the site, which is west of the Athabasca River and directly south of Canadian Natural's Horizon installation.

Teck Resources' January purchase of SilverBirch Energy Corporation strengthens its proposed Frontier oil sands mine with a net cash outlay of $435 million, says Teck president and chief executive officer Don Lindsay.

"Teck now has the opportunity to explore new potential partnerships and other alternatives to move Frontier towards development," he said in a news release. Under the agreement, Teck gains ownership of the proposed Frontier project, previously owned in a 50/50 venture with SilverBirch. A new company will be formed with the remaining SilverBirch assets — including prospective in situ lands at Audet.

Athabasca Oil Sands Corp. has exercised an option to sell its 40 per cent interest in the MacKay River oil sands project to Cretaceous Oilsands Holdings Limited, a wholly owned subsidiary of PetroChina International Investment Limited, for $680 million in cash. ➤

What's new in the oil sands continued

The Feb. 10, 2010, put/call option agreement between Cretaceous and Athabasca granted this option to trigger the sale of Athabasca's interest in the proposed, recently approved 15,0,000-barrel-per-day SAGD project. This will mark the first time PetroChina will act as operator of an oil sands project.

Imperial Oil has approved a $2-billion expansion of its Cold Lake, Alta., cyclic steam stimulation operation in northeastern Alberta. The Nabiye project, expected to start up by year-end 2014, will increase production by more than 40,000 barrels per day to about 200,000 barrels per day.

Imperial received original regulatory approvals for Nabiye in 2004, but in 2010 obtained approval for an amended application to improve the environmental performance of the expansion. The project amendments included a 170-megawatt cogeneration facility to enhance the plant's energy efficiency, a reduction in the number of well pads, reducing the environmental footprint and the addition of sulphur recovery facilities.

Imperial's Cold Lake facility is the largest and longest-running in situ oil sands operation in Canada and includes four steam generation and bitumen production plants.

MEG Energy Corp. now has regulatory authorization to proceed with its Christina Lake Phase 3 project. Engineering work on the 150,000-barrel-per-day facility is currently underway, including a planned $660-million investment this year to assess optimum sizing and timing for the initial phase of the multistage project.

Pengrowth Energy Corporation has commenced the injection of steam at its Lindbergh pilot SAGD project, located in the Cold Lake area. The company says the project is a key component of its growth strategy, with the potential to increase oil and liquids production by up to 80 per cent and 2010 year-end reserves by 61 per cent over the next four years.

"Successfully injecting first steam at our pilot project at Lindbergh is a significant and exciting milestone for Pengrowth," says Steve De Maio, vice president of in situ oil development and operations. "Production from the pilot is expected to increase throughout 2012 to approximately 1,000 barrels of oil per day by year-end and peaking at 1,200 barrels of oil per day later in 2013. A successful proof-of-concept pilot will provide Pengrowth with the certainty needed to develop an initial 12,500-barrel-of-oil-per-day commercial project."

Sunshine Oil Sands Ltd. is going public on the Hong Kong Stock Exchange after receiving ERCB approval for the first phase of the West Ells oil sands project.

West Ells, a 10,000-barrel-per-day oil sands project, is to proceed in two phases of 5,000 barrels per day each, expected to begin construction this year and produce first steam in 2013. The SAGD project is expected to be capable of ultimately producing up to 100,000 barrels per day of bitumen from the Wabiskaw zone over a period of 18 years, with a productive life of more than 50 years.

Project listings

Updated status of oil sands projects in Alberta

As of March 9, 2017

TECHNOLOGY LEGEND

CSS/SAGD	Cyclic steam stimulation/steam assisted gravity drainage
CSS	Cyclic steam stimulation
ES-SAGD	Enriched solvent vapour extraction/steam assisted gravity drainage
N-SOLV	Nsolv solvent vapour extraction
SAGD	Steam assisted gravity drainage
THAI	Toe-to-heel air injection

CURRENT PROJECT	CAPACITY	START UP	REGULATORY STATUS	TECHNOLOGY
NORTH ATHABASCA REGION — MINING				
CANADIAN NATURAL RESOURCES LIMITED				
Horizon				
Canadian Natural says that reliability projects are on track with costs running below budget, a third ore preparation plant is being commissioned. There has been a six-month schedule slip in the Phase 2A plans for a crusher expansion in part due to crusher line rebuild. Long-term contracts have been awarded for the Phase 2B and engineering is on track for Phase 3.				
Phase 1	135,000	2008	Operating	Mining
Phase 2A	80,000	2014	Approved	Mining
Phase 2B	45,000	TBD	Approved	Mining
Phase 3	60,000	TBD	Approved	Mining
IMPERIAL OIL LIMITED				
Kearl				
Imperial Oil says that Kearl Phase 1 is approximately 58 per cent complete. The company has sanctioned Kearl Phase 2.				
Phase 1	110,000	2012	Construction	Mining
Phase 2	110,000	2015	Construction	Mining
Phase 3 Debottleneck	70,000	2020	Approved	Mining
SHELL ALBIAN SANDS				
Jackpine				
The Canadian Environmental Assessment Agency recently invited public comment on a revised draft agreement to establish a joint panel for review of the Pierre River Mine project, as well as revisions to the existing joint panel agreement for the review of the Jackpine Mine expansion project.				
Expansion	100,000	2017	Approved	Mining
Phase 1A	100,000	2010	Operating	Mining
Phase 1B	100,000	TBD	Approved	Mining
Muskeg River				
Commercial	155,000	2002	Operating	Mining
Expansion/Debottlenecking	115,000	TBD	Approved	Mining
Pierre River				
Phase 1	100,000	2019	Application	Mining
Phase 2	100,000	TBD	Application	Mining
SILVERBIRCH ENERGY CORPORATION				
Frontier				
Teck Resources Limited will acquire SilverBirch Energy and a new company will be spun out (SilverWillow Energy Corporation) with the former company's in-situ assets. Teck gains SilverBirch's 50 per cent interest in Frontier.				
Phase 1	75,000	2025	Application	Mining
Phase 2	100,000	2024	Application	Mining
Phase 3	100,000	2027	Application	Mining
Phase 4 Expansion	40,000	2030	Application	Mining

CURRENT PROJECT	CAPACITY	START UP	REGULATORY STATUS	TECHNOLOGY
SUNCOR ENERGY INC.				
Base Operations				
In Q4 of 2016, Suncor began to mine ore from the North Steepbank extension. Additionally, at the upgrader, the Millennium Naphtha Unit is now producing hydrogen and is expected to reach full design rates in early 2017.				
Millennium Debottlenecking	23,000	2008	Operating	Mining
Millennium Mine	294,000	1967	Operating	Mining
North Steepbank Extension	180,000	2012	Construction	Mining
Steepbank Debottleneck Phase 1	4,000	2007	Operating	Mining
Fort Hills				
Current capital expenditures for Fort Hills are around design basis memos and mine engineering.				
Debottleneck	25,000	TBD	Approved	Mining
Phase 1	165,000	2016	Approved	Mining
Voyageur South				
Phase 1	120,000	TBD	Application	Mining
SYNCRUDE CANADA LTD.				
Mildred Lake/Aurora North & South				
Canadian Oil Sands Limited reports that front-end engineering and design is now complete for the $4.6-billion Mildred Lake mine loan replacements. The target in-service date for the $1.6-billion Syncrude Emissions Reduction Project has now been extended into Q1 of 2017.				
Aurora South Train 1	100,000	2016	Approved	Mining
Aurora South Train 2	100,000	2018	Approved	Mining
Base Mine Stage 3 Expansion	290,000	1978	Operating	Mining
Stage 3 Expansion	116,300	2006	Operating	Mining
TOTAL E&P CANADA LTD.				
Joslyn North Mine				
Project partner Suncor Energy says that current capital expenditures are around geological engineering, regulatory and environmental studies.				
Phase 1	100,000	2018	Approved	Mining
Joslyn South Mine				
Phase 1	100,000	TBD	Announced	Mining
Northern Lights Mine				
Phase 1	52,250	TBD	On Hold	Mining
Phase 2	52,250	TBD	On Hold	Mining
NORTH ATHABASCA REGION — IN SITU				
ATHABASCA OIL SANDS CORP.				
Birch				
Phase 1	12,000	TBD	Announced	SAGD

CURRENT PROJECT	CAPACITY	START UP	REGULATORY STATUS	TECHNOLOGY
Dover West Clastics				
Application for the 12,000 barrel per day Phase 1 was filed in December 2011				
Phase 1	12,000	2016	Announced	SAGD
Phase 2	35,000	TBD	Announced	SAGD
Phase 3	35,000	TBD	Announced	SAGD
Dover West Leduc Carbonates				
ACTA says that EM-SAGD pilotting will continue through the end of the first quarter of 2012. Regulatory application for a two phase demonstration project filed in October				
Phase 1 Demonstration	6,000	2014	Application	TAGD
Phase 2 Demonstration	6,000	TBD	Application	TAGD
CANADIAN NATURAL RESOURCES LIMITED				
Birch Mountain				
Phase 1	60,000	2022	Announced	SAGD
Phase 2	60,000	2026	Announced	SAGD
CENOVUS ENERGY INC.				
Telephone Lake Borealis				
Cenovus has filed the environmental impact assessment for a 50,000 barrel per day phase commercial project at Telephone Lake				
Phase A	45,000	TBD	Application	SAGD
Phase B	45,000	TBD	Announced	SAGD
DOVER OPERATING CORP.				
Dover				
Phase 1	50,000	2015	Application	SAGD
Subsequent Phases	200,000	TBD	Application	SAGD
Mackay River				
Petro-Suisse Company Limited has exercised its right to purchase the remaining 40 per cent of the MacKay River project from former partner Athabasca Oil Sands, marking the first time Petro-Suisse will act as the project operator in the oil sands. ERCB project approval granted January 2012				
Phase 1	35,000	2014	Application	SAGD
Phase 2	40,000	2017	Application	SAGD
Phase 3	40,000	2019	Application	SAGD
Phase 4	35,000	TBD	Application	SAGD
E-T ENERGY LTD.				
Poplar Creek				
E-T is now working on what it calls Step 3 of the pilot, intended to look at equipment reliability and fine tuning of the well patterns. The next step will be a commercial 10,000 barrel per day project. E-T plans to access the IPO market in 2012				
Phase 1	10,000	2014	Application	ET-DSP
Phase 2	40,000	2016	Announced	ET-DSP
Pilot	1,000	2007	Operating	ET-DSP
HUSKY ENERGY INC.				
Sunrise				
Husky says Phase 1 construction remains on schedule for first production in 2014. More than half of the 49 SAGD well pairs are complete and Husky says drilling costs are trending on budget. Installation of foundations for the steam plant and delivery of first major equipment began in January				
Phase 1	60,000	2014	Construction	SAGD
Phase 2	50,000	2016	Approved	SAGD
Phase 3	50,000	TBD	Approved	SAGD
Phase 4	50,000	TBD	Approved	SAGD
IVANHOE ENERGY INC.				
Tamarack				
Ivanhoe says it delivered the responses to the ERCB's first round of supplemental information requests relating to its application in November 2011				
Phase 1	20,000	2017	Application	SAGD
Phase 2	20,000	TBD	Application	SAGD

CURRENT PROJECT	CAPACITY	START UP	REGULATORY STATUS	TECHNOLOGY
MARATHON OIL CORPORATION				
Birchwood				
Pilot	12,000	2016	Announced	SAGD
OAK POINT ENERGY LTD.				
Lewis				
Oak Point Energy reports that engineering and procurement is ongoing				
Pilot	1,250	2013	Application	SAGD
ROYAL DUTCH SHELL PLC				
Grosmont				
The project, which would incorporate electrical heaters, has been delayed. Lone Pine Energy's May purchase of additional leases in the Grosmont carbonate zone included "non-core" portions of Shell Canada's Grosmont acreage				
Pilot	TBD	TBD	On Hold	SAGD
SOUTHERN PACIFIC RESOURCE CORP.				
STP McKay				
Southern Pacific says construction is nearing completion and it remains on track for first steam near the end of Q2 of 2012, with production to commence three to four months from first steam date				
Phase 1	12,000	2012	Construction	SAGD
Phase 2A	12,000	2015	Application	SAGD
Phase 2B	12,000	TBD	Application	SAGD
SUNCOR ENERGY INC.				
Firebag				
Suncor says that, exiting 2011, bitumen production from its in situ assets is poised approximately 30 per cent over 2010, primarily due to the ramp up of operations from Firebag Stage 3 and new infill wells at the Firebag project				
Expansion and Expansion	25,000	2007	Operating	SAGD
Stage 1	35,000	2004	Operating	SAGD
Stage 2	35,000	2006	Operating	SAGD
Stage 3	62,500	2011	Operating	SAGD
Stage 3 Debottleneck	25,000	TBD	Application	SAGD
Stage 4	62,500	2013	Construction	SAGD
Stage 5	62,500	2018	Approved	SAGD
Stage 6	62,500	2019	Approved	SAGD
Lewis				
Phase 1	40,000	TBD	Application	SAGD
Phase 2	40,000	TBD	Application	SAGD
MacKay River				
Suncor has confirmed that the MacKay River expansion is a key part of its near-term plans. The company will spend $30 million on the project in 2011				
MR2	40,000	2016	Application	SAGD
Phase 1	33,000	2002	Operating	SAGD
SUNSHINE OILSANDS LTD.				
Harper				
Sunshine Oilsands is modelling for a second cyclic steam stimulation cycle at its Harper pilot, repeatedly with a number of production improvements to better understand and operate the scheme				
Carbonate Pilot	1,000	2011	Operating	SAGD
Legend Lake				
Sunshine Oilsands has filed its application for the Legend Lake SAGD project				
Phase 1	10,000	2013	Application	SAGD
Phase 2	10,000	TBD	Announced	SAGD
Phase 2 Expansion	10,000	TBD	Announced	SAGD
Phase 3	10,000	TBD	Announced	SAGD
Phase 3 Expansion	10,000	TBD	Announced	SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Thickwood				
Suncor Energy Inc. has submitted the regulatory application for the Thickwood SAGD project, with operating project start-up in 2015.				
Phase 1	30,000	2015	Application	SAGD
Phase 2	20,000	2017	Announced	SAGD
Phase 2 Expansion	20,000	2020	Announced	SAGD
West Ells				
Suncor has received regulatory approval to proceed with a 80,000 barrel per day SAGD project at West Ells. Former Harvest Operations Corp. John Zhary has been appointed president and COO.				
Phase 1	5,000	2017	Approved	SAGD
Phase 2	5,000	2018	Approved	SAGD
Phase 3	40,000	2018	Announced	SAGD
Phase 4	40,000	2024	Announced	SAGD
VALUE CREATION INC.				
Terre de Grace				
Pilot	10,000	TBD	Approved	SAGD
SOUTH ATHABASCA REGION – IN SITU				
ALBERTA OILSANDS INC.				
Clearwater West				
Alberta Oilsands Inc. has received approval for the Clearwater West pilot in 2012, with construction to follow. Shahir Prompt has retired as chairman and CEO, replaced by interim CEO Michael Lee and chairman Jack Crawford.				
Phase 2	25,000	2016	Announced	SAGD
Pilot	1,500	2012	Application	SAGD
ATHABASCA OIL SANDS CORP.				
Hangingstone				
As of 2010, the engineering design basis memorandum is complete, and certain long-lead items have been procured, such as evaporators and boilers. Construction is targeted to start in late 2012.				
Phase 1	12,000	2014	Application	SAGD
Phase 2	25,000	2017	Announced	SAGD
Phase 3	25,000	2019	Announced	SAGD
BLACKPEARL RESOURCES INC.				
Blackrod				
Alberta Environment and Water is preparing the final terms of reference for the commercial project phases. BlackPearl says production at the pilot is now over 300 barrels per day with an instantaneous SOR of less than 3:1, exceeding model expectations. The application for the 30,000 barrel per day commercial project is nearing completion, and will be submitted to the regulator in Q3 of 2012.				
Phase 1	30,000	2016	Announced	SAGD
Phase 2	30,000	TBD	Announced	SAGD
Phase 3	30,000	TBD	Announced	SAGD
Pilot	TBD	2011	Operating	SAGD
CANADIAN NATURAL RESOURCES LIMITED				
Gregoire Lake				
Phase 1	60,000	2024	Announced	TBA
Grouse				
Regulatory applications are expected for early 2012. Alberta Environment has issued its final terms of reference for the Grouse environmental impact assessment.				
Commercial	40,000	2019	Announced	SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
Kirby (North)				
CNRL has submitted the environmental impact assessment for all phases at Kirby North and South.				
Phase 1	50,000	2016	Application	SAGD
Phase 2	80,000	2019	Application	SAGD
Kirby (South)				
Canadian Natural says condos foundations on track and on budget. The company has submitted the environmental impact assessment for all phases of expansion at Kirby North and South.				
Phase 1	40,000	2013	Construction	SAGD
Phase 2	35,000	2020	Application	SAGD
CENOVUS ENERGY INC.				
Christina Lake				
Construction of Phase D is more than 70 per cent complete and production is expected in Q4. Construction of Phase E is more than 30 per cent complete, with initial production expected in Q4 of 2011. Ground preparation continues for Phase F. Production capacity for both Phases E and G has been increased by 10,000 barrels per day to 50,000 barrels per day each.				
Phase 1A	10,000	2002	Operating	SAGD
Phase 1B	8,000	2008	Operating	SAGD
Phase C	40,000	2011	Operating	SAGD
Phase D	40,000	2012	Construction	SAGD
Phase E	40,000	2013	Approved	SAGD
Phase F	50,000	2016	Approved	SAGD
Phase G	50,000	2017	Approved	SAGD
Phase H	40,000	2019	Announced	SAGD
Foster Creek				
Ground preparation is now complete for Phases F–H. At Phase F, site preparation and the installation of pipe racks continues to progress on schedule.				
Phase A	24,000	2001	Operating	SAGD
Phase B (Debottlenecked)	8,000	2003	Operating	SAGD
Phase C, Train 1	30,000	2005	Operating	SAGD
Phase C, Train 2	20,000	2007	Operating	SAGD
Phase D	30,000	2009	Operating	SAGD
Phase E	30,000	2009	Operating	SAGD
Phase F	45,000	2014	Construction	SAGD
Phase G	40,000	2015	Approved	SAGD
Phase H	40,000	2016	Approved	SAGD
Phase I	45,000	2017	Announced	SAGD
Narrows Lake				
Alberta Environment has deemed complete the environmental impact assessment for the Narrows Lake project.				
Phase 1	45,000	2017	Application	SAGD
Phase 2	45,000	TBD	Application	SAGD
Phase 3	45,000	TBD	Application	SAGD
Pelican Lake Grand Rapids				
Cenovus has filed the environmental impact assessment for a commercial project at Pelican Grand Rapids.				
Phase A	60,000	2017	Application	SAGD
Phase B	60,000	TBD	Application	SAGD
Phase C	60,000	TBD	Application	SAGD
Pilot	600	2011	Operating	SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
CONNACHER OIL AND GAS LIMITED				
Great Divide				
Algar Pod 2	10,000	2010	Operating	SAGD
Expansion	24,000	2014	Application	SAGD
Pod 1	10,000	2007	Operating	SAGD
CONOCOPHILLIPS CANADA LIMITED				
Surmont				
Phase 1	27,000	2007	Operating	SAGD
Phase 2	109,000	2015	Construction	SAGD
Pilot	1,200	1997	Operating	SAGD
DEVON CANADA CORPORATION				
Jackfish				
Phase 1	35,000	2007	Operating	SAGD
Phase 2	35,000	2011	Operating	SAGD
Phase 3	35,000	2015	Construction	SAGD
Pike				
1A	35,000	2016	Announced	SAGD
1B	35,000	2017	Announced	SAGD
1C	35,000	2017	Announced	SAGD
GRIZZLY OIL SANDS ULC				
Algar Lake				
Phase 1	5,660	2011	Construction	SAGD
Phase 2	5,660	2014	Approved	SAGD
HARVEST OPERATIONS CORP.				
BlackGold				
Phase 1	10,000	2014	Construction	SAGD
Phase 2	20,000	2015	Application	SAGD
HUSKY ENERGY INC.				
McMullen				
Air Injection Pilot Experimental	750	2012	Construction	SAGD
JAPAN CANADA OIL SANDS LIMITED				
Hangingstone				
Expansion	35,000	2015	Application	SAGD
Hangingstone Pilot				
Pilot	10,000	1999	Operating	SAGD

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
LARICINA ENERGY LTD.				
Germain				
Phase 1 Commercial Demonstration	5,000	2011	Construction	SAGD
Phase 2	30,000	2015	Application	SAGD
Phase 3	60,000	2018	Application	SAGD
Phase 4	60,000	2021	Application	SAGD
Saleski				
Phase 1	10,700	2014	Application	SAGD
Pilot	1,800	2011	Operating	SAGD
MEG ENERGY CORPORATION				
Christina Lake				
Phase 1Pilot	1,000	2008	Operating	SAGD
Phase 2A	22,000	2009	Operating	SAGD
Phase 2B	35,000	2011	Construction	SAGD
Phase 3A	50,000	2016	Approved	SAGD
Phase 3B	50,000	2018	Approved	SAGD
Phase 3C	50,000	2020	Approved	SAGD
Surmont				
Phase 1	50,000	2018	Announced	SAGD
Phase 2	50,000	TBD	Announced	SAGD
N-SOLV CORPORATION				
Dover				
Demonstration Plant	500	2012	Announced	N-SOLV
NEXEN INC.				
Long Lake				
Long Lake South (Kinosis) Phase 1	40,000	TBD	Approved	SAGD
Long Lake South (Kinosis) Phase 2	40,000	TBD	Approved	SAGD
Phase 1	72,000	2008	Operating	SAGD
Phase 2	72,000	TBD	Approved	SAGD
Phase 3	72,000	TBD	Application	SAGD
Phase 4	72,000	TBD	Announced	SAGD
PARAMOUNT RESOURCES LTD.				
Hoole				
Commercial	10,000	2015	Announced	SAGD

CURRENT PROJECT	CAPACITY	START UP	REGULATORY STATUS	TECHNOLOGY
PETROBANK ENERGY AND RESOURCES LTD.				
Conklin (Whitesands)				
Expansion	3,900	TBD	On Hold	THAI
Pilot	1,900	2006	Suspended	THAI
May River				
Phase 1	83,000	2011	Application	THAI
Subsequent Phases	90,000	TBD	Disclosed	THAI
STATOIL				
Kai Kos Dehseh				
Corner	40,000	2015	Approved	SAGD
Corner Expansion	40,000	TBD	Application	SAGD
Hangingstone	20,000	TBD	Application	SAGD
Leismer Commercial	10,000	TBD	Approved	SAGD
Leismer Demonstration	10,000	2010	Operating	SAGD
Leismer Expansion	20,000	TBD	Application	SAGD
Leismer Northwest	20,000	TBD	Application	SAGD
Leismer South	20,000	TBD	Application	SAGD
Thornbury	40,000	TBD	Application	SAGD
Thornbury Expansion	20,000	TBD	Application	SAGD
SUNCOR ENERGY INC.				
Chard				
Phase 1	40,000	TBD	Announced	SAGD
Meadow Creek				
Phase 1	40,000	TBD	Approved	SAGD
Phase 2	40,000	TBD	Approved	SAGD
VALUE CREATION INC.				
TriStar				
Pilot	1,000	2012	Application	SAGD
COLD LAKE REGION – IN SITU				
CANADIAN NATURAL RESOURCES LIMITED				
Primrose/Wolf Lake				
Primrose East	32,000	2008	Operating	CSS
Primrose North	30,000	2006	Operating	CSS
Primrose South	45,000	1985	Operating	CSS
Wolf Lake	11,000	1985	Operating	CSS
HUSKY ENERGY INC.				
Caribou				
Demonstration	10,000	TBD	Approved	SAGD
Tucker				
Phase 1	30,000	2006	Operating	SAGD
IMPERIAL OIL LIMITED				
Cold Lake				
Phase 10	110,000	1985	Operating	CSS
Phase 11-13	30,000	2002	Operating	CSS
Phase 14-16	40,000	2014	Construction	CSS

CURRENT PROJECT	CAPACITY	START UP	REGULATORY STATUS	TECHNOLOGY
KOCH EXPLORATION CANADA CORPORATION				
Gemini				
Phase 1	5,000	TBD	Approved	SAGD
Phase 2	5,000	TBD	Approved	SAGD
OSUM OIL SANDS CORP.				
Taiga				
Phase 1	11,500	2014	Application	SAGD
Phase 2	17,500	2016	Application	SAGD
PENGROWTH CORPORATION				
Lindbergh				
Phase 1 Commercial	12,500	2014	Application	SAGD
Phase 2 Commercial	12,500	2016	Announced	SAGD
Pilot	1,200	2012	Operating	SAGD
ROYAL DUTCH SHELL PLC				
Orion				
Phase 1	10,000	2007	Operating	SAGD
Phase 2	10,000	TBD	Approved	SAGD
PEACE RIVER REGION – IN SITU				
ANDORA ENERGY CORPORATION				
Sawn Lake				
SAGD Demonstration	1,800	TBD	Approved	SAGD
NORTHERN ALBERTA OIL LTD.				
Sawn Lake				
CSS Pilot	500	TBD	Approved	CSS
PETROBANK ENERGY AND RESOURCES LTD.				
Dawson				
Phase 1	10,000	TBD	Announced	THAI
THAI Demonstration	TBD	TBD	Construction	THAI
ROYAL DUTCH SHELL PLC				
Peace River				
Cadotte Lake	12,500	1986	Operating	CSS
Carmon Creek – Phase 1	40,000	2015	Application	CSS
Carmon Creek – Phase 2	40,000	TBD	Application	CSS
SOUTHERN PACIFIC RESOURCE CORP.				
Red Earth				
Commercial	10,000	TBD	Announced	CSS
Pilot	3,000	2009	Operating	CSS
Pilot Expansion	4,000	TBD	Announced	CSS

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
SASKATCHEWAN REGION — IN SITU				
OILSANDS QUEST INC.				
Axe Lake				
Commercial	30,000	TBD	On Hold	SAGD
Reservoir Test	600	2008	On Hold	SAGD
SAGD Pilot	TBD	TBD	On Hold	SAGD
NORTH ATHABASCA REGION — UPGRADER				
CANADIAN NATURAL RESOURCES LIMITED				
Horizon				
Phase 1	114,000	2009	Operating	Mining
Phase 2A	10,000	2014	Approved	Mining
Phase 2B	45,000	TBD	Approved	Mining
Phase 3	80,000	TBD	Approved	Mining
IVANHOE ENERGY INC.				
Tamarack				
Phase 1	34,784	2014	Application	Upgrader
SUNCOR ENERGY INC.				
Base Operations				
Millennium Coker Unit	97,000	2008	Operating	Upgrader
Millennium Vacuum Unit	35,000	2005	Operating	Upgrader
U1 and U2	225,000	1967	Operating	Upgrader
Fort Hills				
Phase 1	145,000	TBD	On Hold	Upgrader
Phase 2 & 3	145,000	TBD	On Hold	Upgrader
Voyageur Upgrader 3				
Phase 1	137,000	2017	Approved	Upgrader
Phase 2	63,000	TBD	Approved	Upgrader
SYNCRUDE CANADA LTD.				
Mildred Lake/Aurora North & South				
Base Plant Stage 1 & 2 Debottleneck	250,000	1978	Operating	Upgrader
Stage 3 Debottleneck	75,000	TBD	Announced	Upgrader
Stage 3 Expansion (UE-1)	100,000	2006	Operating	Upgrader
VALUE CREATION INC.				
Terre de Grace				
Phase 1	33,600	TBD	Announced	Upgrader
Phase 2	33,600	TBD	Announced	Upgrader
Pilot	8,400	TBD	Approved	Upgrader

CURRENT PROJECT	CAPACITY	START-UP	REGULATORY STATUS	TECHNOLOGY
SOUTH ATHABASCA REGION — UPGRADER				
NEXEN INC.				
Long Lake				
Phase 1	58,500	2008	Operating	Upgrader
Phase 2	58,500	TBD	Approved	Upgrader
Phase 3	58,500	TBD	Announced	Upgrader
Phase 4	58,500	TBD	Announced	Upgrader
VALUE CREATION INC.				
TriStar				
Pilot	840	TBD	Application	Upgrader
INDUSTRIAL HEARTLAND REGION — UPGRADER				
NORTH WEST UPGRADING INC.				
Redwater Upgrader				
Phase 1	77,000	TBD	Approved	Upgrader
Phase 2	77,000	TBD	Approved	Upgrader
Phase 3	77,000	TBD	Approved	Upgrader
SHELL ALBIAN SANDS				
Scotford Upgrader 1				
Commercial	158,000	2003	Operating	Upgrader
Expansion	91,000	2011	Operating	Upgrader
Scotford Upgrader 2				
Phase 1	97,750	TBD	Cancelled	Upgrader
Phase 2	97,750	TBD	Cancelled	Upgrader
Phase 3	97,750	TBD	Cancelled	Upgrader
Phase 4	97,750	TBD	Cancelled	Upgrader
STATOIL				
Strathcona				
Phase 1	65,000	TBD	Cancelled	Upgrader
Phase 2	152,000	TBD	Cancelled	Upgrader
TOTAL E&P CANADA LTD.				
Northern Lights				
Phase 1	50,600	TBD	Cancelled	Upgrader
Phase 2	50,600	TBD	Cancelled	Upgrader
Strathcona				
Debottlenecking	46,000	TBD	Cancelled	Upgrader
Phase 1	138,000	TBD	Cancelled	Upgrader
Phase 2	82,000	TBD	Cancelled	Upgrader
VALUE CREATION INC.				
Heartland				
Phase 1	46,300	TBD	On Hold	Upgrader
Phase 2	46,300	TBD	Approved	Upgrader
Phase 3	46,300	TBD	Approved	Upgrader

Glossary of oil sands terms

API

An American Petroleum Institute measure of liquid gravity. Water is 10 degrees API, and a typical light crude is from 35 to 40. Bitumen is 7.5 to 8.5.

Barrel

The traditional measurement for crude oil volumes. One barrel equals 42 U.S. gallons (159 litres). There are 6.29 barrels in one cubic metre of oil.

Bitumen

Naturally occurring, viscous mixture of hydrocarbons that contains high levels of sulphur and nitrogen compounds. In its natural state, it is not recoverable at a commercial rate through a well because it is too thick to flow. Bitumen typically makes up about 10 per cent by weight of oil sand, but saturation varies.

Condensate

Mixture of extremely light hydrocarbons recoverable from gas reservoirs. Condensate is also referred to as a natural gas liquid, and is used as a diluent to reduce bitumen viscosity for pipeline transportation.

Cyclic steam stimulation (CSS)

For several weeks, high-pressure steam is injected into the formation to soften the oil sand before being pumped to the surface for separation. The pressure created in the underground environment causes formation cracks that help move the bitumen to producing wells. After a portion of the reservoir has been saturated, the steam is turned off and the reservoir is allowed to soak for several weeks. Then the production phase brings the bitumen to the surface.

Density

The heaviness of crude oil, indicating the proportion of large, carbon-rich molecules, generally measured in kilograms per cubic metre (kg/m³) or degrees on the American Petroleum Institute (API) gravity scale. In western Canada, oil up to 900 kg/m³ is considered light- to medium-crude—oil above this density is deemed as heavy oil or bitumen.

Diluent

See Condensate.

Established recoverable reserves

Reserves recoverable under current technology and present and anticipated economic conditions, plus that portion of recoverable reserves that is interpreted to exist, based on geological, geophysical or similar information, with reasonable certainty.

Established reserves

Reserves recoverable with current technology and present and anticipated economic conditions, specifically proved by drilling, testing or production, plus the portion of contiguous recoverable reserves that are interpreted to exist from geological, geophysical or similar information with reasonable certainty.

Extraction

A process, unique to the oil sands industry, which separates the bitumen from the oil sand using hot water, steam and caustic soda.

Froth treatment

The means to recover bitumen from the mixture of water, bitumen and solids "froth" produced in hot water extraction (in mining-based recovery).

Gasification

A process to partially oxidize any hydrocarbon, typically heavy residues, to a mixture of hydrogen and carbon monoxide. Can be used to produce hydrogen and various energy byproducts.

Greenhouse gases

Gases commonly believed to be connected to climate change and global warming. CO_2 is the most common, but greenhouse gases also include other light hydrocarbons (such as methane) and nitrous oxide.

Initial established reserves

Established reserves prior to the deduction of any production.

Initial volume in place

The volume calculated or interpreted to exist in a reservoir before any volume has been produced.

In situ

Latin for "in place." In situ recovery refers to various methods used to recover deeply buried bitumen deposits.

In situ combustion

A displacement enhanced oil recovery method. It works by generating combustion gases (primarily CO and CO_2) downhole, which then "pushes" the oil towards the recovery well.

Lease

A legal document from the province of Alberta giving an operator the right to extract bitumen from the oil sand existing within the specified lease area. The land must be reclaimed and returned to the Crown at the end of operations.

Muskeg

A water-soaked layer of decaying plant material, one to three metres thick, found on top of the overburden.

Oil sands

...umen soaked sand, located in four geographic regions of Alberta: Athabasca, Wabasca, Cold Lake and Peace River. The Athabasca deposit is the largest, encompassing more than 42,340 square kilometres. Total deposits of bitumen in Alberta are estimated at 1.7 trillion to 2.5 trillion barrels.

Overburden

A layer of sand, gravel and shale between the surface and the underlying oil sand. Must be removed before oil sands can be mined. Overburden underlies muskeg in many places.

Pilot plant

Small model plant for testing processes under actual production conditions.

Proven recoverable reserves

Reserves that have been proven through production or testing to be recoverable with existing technology and under present economic conditions.

Reclamation

Returning disturbed land to a stable, biologically productive state. Reclaimed property is returned to the province of Alberta at the end of operations.

Remaining established reserves

Initial reserves less cumulative production.

Royalty

The Crown's share of production or revenue. About three-quarters of Canadian crude oil is produced from lands, including the oil sands, on which the Crown holds mineral rights. The lease or permit between the developer and the Crown sets out the arrangements for sharing the risks and rewards.

Steam assisted gravity drainage (SAGD)

An in situ production process using two closely spaced horizontal wells, one for steam injection and the other for production of the bitumen/water emulsion.

Synthetic crude oil (SCO)

A manufactured crude oil composed of naphtha, distillate and gas oil-boiling range material. Can range from high-quality, light sweet bottomless crude to heavy, sour blends.

Tailings

A combination of water, sand, silt and fine clay particles that are a byproduct of removing the bitumen from the oil sand.

Tailings settling basin

The primary purpose of the tailings settling basin is to serve as a process vessel allowing time for tailings water to clarify and silt and clay particles to settle, so the water can be reused in extraction. The settling basin also acts as a thickener, preparing mature fine tails for final reclamation.

Thermal recovery

Any process by which heat energy is used to reduce the viscosity of bitumen in situ to facilitate recovery.

Toe to heel air injection (THAI)

An in situ combustion method for producing heavy oil and oil sand. In this technique, combustion starts from a vertical well, while the oil is produced from a horizontal well having its toe in close proximity to the vertical air injection well. This production method is a modification of conventional fire flooding techniques in which the flame front from a vertical well pushes the oil to be produced from another vertical well.

Truck-and-shovel mining

Large electric or hydraulic shovels are used to remove the oil sand and load very large trucks. The trucks haul the oil sand to dump pockets where it is conveyed or pipelined to the extraction plant. Trucks and shovels are more economic to operate than the bucket-wheel reclaimers and draglines they have replaced at oil sands mines.

Upgrading

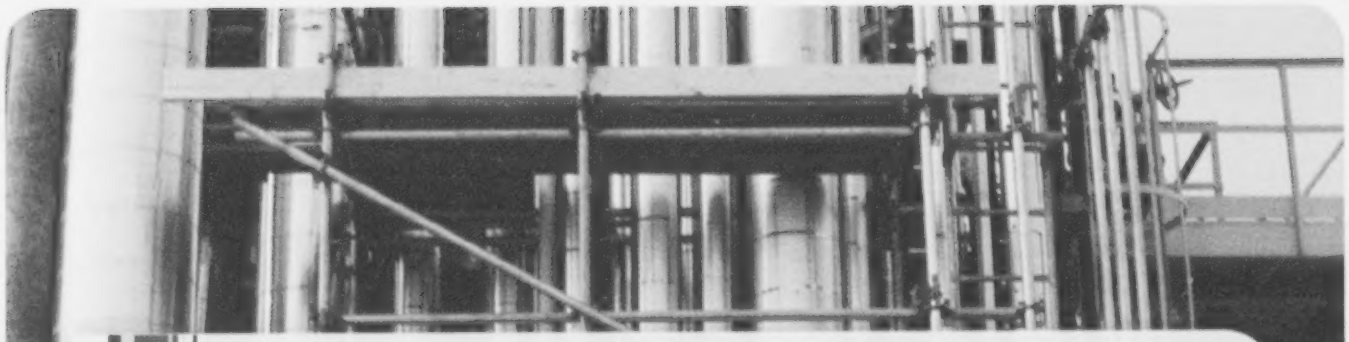
The process of converting heavy oil or bitumen into synthetic crude either through the removal of carbon (coking) or the addition of hydrogen (hydroconversion).

Vapour extraction (VAPEX)

VAPEX is a non-thermal recovery method that involves injecting a gaseous hydrocarbon solvent into the reservoir where it dissolves into the sludge-like oil, which becomes less viscous (or more fluid) before draining into a lower horizontal well and being extracted.

Viscosity

The ability of a liquid to flow. The lower the viscosity, the more easily the liquid will flow.



CONTACTS

Oil Sands Producers

- Alberta Oilsands
- Andora Energy
- Athabasca Oil Sands
- Baytex Energy
- BlackPearl Resources
- Canadian Natural Resources
- Cenovus Energy
- Chevron Canada
- China National Offshore Oil Corporation
- Connacher Oil and Gas
- ConocoPhillips Canada
- Devon Canada
- Dover Operating Corp.
- Enerplus Resources Fund
- E-T Energy
- Grizzly Oil Sands
- Harvest Operations Corp.
- Husky Energy
- Imperial Oil
- Ivanhoe Energy
- Japan Canada Oil Sands
- Koch Exploration Canada
- Korea National Oil Corporation
- Laricina Energy
- Marathon Oil
- MEG Energy
- Nexen
- North West Upgrading
- N-Solv
- Oak Point Energy
- Occidental Petroleum Corporation
- Oilsands Quest
- OSUM Oil Sands
- Pan Orient Energy
- Paramount Resources Ltd.
- Pengrowth Energy Trust
- Petrobank Energy and Resources
- PetroChina
- Shell Canada
- SilverBirch Energy
- Sinopec
- Southern Pacific Resource Corp.
- Statoil Canada
- Suncor Energy
- Sunshine Oilsands
- Syncrude
- Talisman Energy
- Teck Resources
- Total E&P Canada
- Value Creation Group

Associations/Organizations

- Alberta Building Trades Council
- Alberta Chamber of Resources
- Alberta Chambers of Commerce
- Alberta Energy
- Alberta Environment and Water
- Alberta Innovates
- Alberta Treasury Board and Enterprise
- Alberta's Industrial Heartland Association
- Canada's Oil Sands Innovation Alliance
- Canadian Association of Geophysical Contractors
- Canadian Association of Petroleum Producers
- Canadian Heavy Oil Association
- Canadian Oil Sands Network for Research and Development
- Energy Resources Conservation Board
- In Situ Oil Sands Alliance
- Lakeland Industry and Community Association
- Natural Resources Conservation Board
- Oil Sands Developers Group
- Oil Sands Secretariat
- Petroleum Technology Alliance Canada

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